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to discharge so much of its contents that the surface would approach the bottom.

It is evident, that by this method, a standard may be formed for any length, superficies, or capacity, and also for any weight, if the specific gravity of the water made use of be given.

N^o. XL.

Description of a SPRING-BLOCK, designed to assist a vessel in Sailing. By FRANCIS HOPKINSON, ESQ. of Philadelphia.

Honoured with the Magellanic Gold Medal, by an award of the Society, in December, 1790.

IT is an acknowledged fact, that when the shrouds of a vessel are braced very tight, so as to prevent the masts from having any play or spring, she will not sail as fast as when her masts are permitted to bend a little to the impulses of the wind. The reason is, that the wind is seldom uniform in its force for any length of time; and it is impossible that a sudden encrease of impulse should *instantaneously* communicate a proportionable velocity to so heavy a body, placed in a resisting medium of so great density.

In such case the vessel is forcibly pressed into or against the water, and is obliged to heel from the blast, until a progressive motion, adequate to the force impressed can be communicated to the whole mass. But these sudden pressures against the water and this heeling of the vessel, are great obstacles to fast sailing: in as much as they oc-

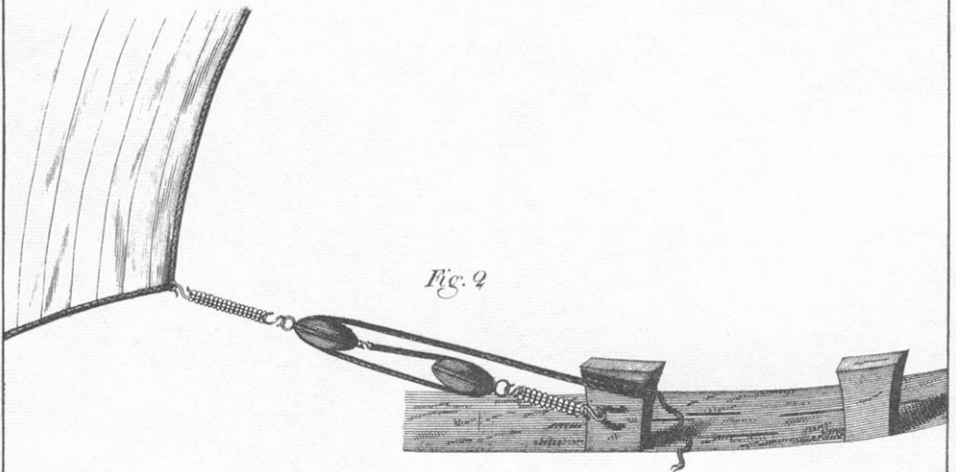
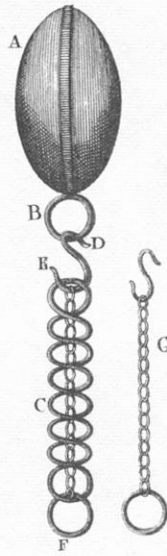
caſion an unprofitable expenditure of the force which ſhould push her forward.

When a veſſel firſt hoifts her ſails, although ſhe may be in a ſituation to receive the full impulſe of the wind, yet ſhe will not *immediately* proceed with the velocity which ſhe will afterwards acquire from the ſame force : having not yet *got under way*, as the ſeamen expreſs it. Upon the ſame principle, when a veſſel is ſailing at the rate of five knots, if a ſudden blaſt of wind ſhould come, which would enable her to make ſeven knots, ſhe may be conſidered as being perfectly ſtationary with reſpect to the two additional knots, and will require ſome time to *get under way* as to them. Now the effect produced by relaxing the ſhrouds is, that the maſt, receiving the firſt impreſſion of the wind upon the ſails, acts as a ſpring, and yielding to the impulſe, gradually communicates motion to the whole veſſel, giving her time to *get under way*, and occaſioning an eaſy tranſition from one degree of velocity to another : ſo that her way is not checked by her being ſuddenly urged againſt the reſiſting medium on the acceſſion of every new force impreſſed.

But the miſfortune is, that this advantageous uſe of the maſt can be exerciſed only to a ſmall extent ; for, if it is allowed too much play, it will be in danger of breaking. The object of the preſent propoſal is to enjoy the ſame benefit to a greater extent and with more ſecurity.

The maſts, yards and rigging of a ſhip receive the firſt impulſes of the wind. All theſe are in ſome degree eluſtic Every twiſted rope is a ſpiral ſpring, and every ſpar capable of being a little bent. But let us ſuppoſe that the ropes were all compoſed of ſtraight ſtrands, that the maſts and yards were inflexible, and the ſails made of thin light wood ; in ſuch caſe, I ſuppoſe, that the veſſel in ſailing by the wind would make but little head-way, whatever the

the



the shape of her bottom might be: but would expend the force of the wind in heeling and flipping to leeward. If this is true, her failing must be considerably assisted by any means that shall encrease the active spring of her rigging. For this purpose I have contrived what I call a SPRING-BLOCK, to be applied to all such parts of the rigging as will admit of it with safety and convenience, and where its operation will be most advantageous; but particularly to the sheet-ropes, and, if practicable, to the dead eyes in lieu of what are called the chains.

Description.

A, fig. 1, Is a block made in the usual manner, having a ring or eye B at one end. C, is a spiral spring linked at one end to the hook D E and at the other to the ring F, which is to be annexed by a staple to the timber-head, or by some other means, to the place where it is to be applied. The spring C, must be of well tempered steel, and proportioned in strength to the service it is to perform. Within the cavity or pipe formed by the spiral spring, there must be a *chain* of a suitable strength called a *check-chain* (represented separate at G) connected by links to the rings D and F. When the spring is not in action this chain is slack; but when the spiral spring is extended by the force of the wind as far as it can be without danger of injury; the check-chain must then begin to bear, to prevent its further extension; and, if strong enough, will be an effectual security against failure.

Fig. 2. represents part of the gun-wale of a sloop with the spring-blocks in action, one of them hooked to a staple in the timber-head, and the other to the corner of the jib.

My expectation is that a vessel thus furnished will be less liable to heel, that she will receive the impulses of the wind to better advantage, and sail with a more lively and equable motion, than if rigged in the common way.

Vires acquirit cedendo.

Nº. XLI